

Rhabdomyolysis

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Rhabdomyolysis is the rapid breakdown (*lysis*) of skeletal muscle tissue (*rhabdomyo*) due to injury to muscle tissue. The muscle damage may be caused by physical (e.g. crush injury), chemical, or biological factors. The destruction of the muscle leads to the release of the breakdown products of damaged muscle cells into the bloodstream; some of these, such as myoglobin, are harmful to the kidney and may lead to acute kidney failure. Treatment is with intravenous fluids, and dialysis or hemofiltration if necessary.^[1]

Rhabdomyolysis and its complications are major problems in people who are injured in disasters such as earthquakes and bombing. The disease and its mechanisms were first elucidated in the Blitz of London in 1941.^[2]

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Rhabdomyolysis

Classification & external resources



Model of helical domains in myoglobin, the protein linked to kidney damage in rhabdomyolysis.

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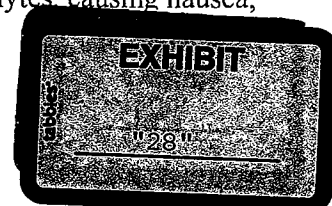
MeSH D012206

Signs and symptoms

Most cases of rhabdomyolysis develop as a result of muscle injury or strain, or other external causes (such as medication or intoxication). However, the cause is not always directly evident. Pain, tenderness, weakness and edema (swelling) of the affected muscles may be present. Other symptoms are nonspecific and result either from the consequences of the breakdown in muscle tissue, or from the condition that caused the muscle breakdown.^{[1][3]}

Swelling of the damaged muscle occasionally leads to compartment syndrome, the compression by swollen muscle of surrounding tissues in the same fascial compartment (such as nerves and blood vessels), leading to damage or loss of function in the part of the body supplied by these structures. Symptoms of this complication include decreased blood supply, decrease in sensation, or pain in the affected limb.^[3]

Release of the components of muscle tissue into the bloodstream leads to disturbances in electrolytes, causing nausea,



vomiting, confusion, coma and cardiac arrhythmias (abnormal heart rate and rhythm). Furthermore, damage to the kidneys may lead to dark (tea-colored) urine or a marked decrease (oliguria) or absence (anuria) of urine production, usually about 12-24 hours after the initial muscle damage. Finally, disruptions in blood clotting may lead to the development of a state called disseminated intravascular coagulation.^{[1][3]}

Causes

Anything that destroys muscle tissue can cause rhabdomyolysis. The causes of rhabdomyolysis can be classified as either physical or non-physical. Physical rhabdomyolysis is in some situations confined to a particular area of the body, while rhabdomyolysis due to other causes tends to affect all muscles simultaneously.^[1]

Physical causes

Recognized physical causes for rhabdomyolysis are:^[1]

- Traumatic compression of muscles: crush syndrome (e.g. in earthquakes), car accident, confinement in a fixed position (e.g. after a stroke, due to drunkenness or in prolonged surgery), physical torture or abuse
- Obstruction of blood supply to muscles: arterial thrombosis (blood clots forming locally) or embolism (clots or other debris from elsewhere in the body), clamping of an artery during surgery, generally reduced blood supply in shock or sepsis (due to any cause)
- Excessive muscle strain or activity: extreme physical exercise (particularly when poorly hydrated), delirium tremens (alcohol withdrawal), tetanus, prolonged seizures or status epilepticus
- Electrical: lightning, high-voltage electric shock, including electroshock weapon injuries^[4].



Alfred P. Murrah Federal Building after a 1995 bombing that injured or killed more than 1,000 people. Collapsing buildings can cause crush injuries that trigger rhabdomyolysis.

Non-physical causes

Non-physical causes reported to cause rhabdomyolysis include:^[1]

- Disorders of muscle energy supply (usually hereditary enzyme problems): carnitine deficiency, CPT type I or type II deficiency, McArdle's disease, various defects in the mitochondrial respiratory chain, phosphofructokinase deficiency
- Poisons such as heavy metals and venom from insects or snakes
- Foodborne toxins, e.g. coniine from quail that have consumed hemlock (coturnism),^[5] *Tricholoma equestre* mushrooms in France and Poland,^[6] and an unidentified toxin in fish (Haff disease)^[7]
- Drugs of abuse,^[8] including: ethanol,^[9] methamphetamines,^[10] cocaine,^[11] heroin,^[12] phencyclidine (PCP),^[13] ketamine,^[14] 3,4-methylenedioxymethamphetamine (MDMA or Ecstasy),^{[15][16]}
- Medications:
 - statins, especially when prescribed in combinations with fibrates. Cerivastatin (Baycol) was withdrawn in 2001 after numerous reports of rhabdomyolysis. Other statins have a small risk of 0.44 cases per 10,000 patients annually, which increases to 5.98 if a fibrate is added.^[17] However, other studies detected no increased risk from statins.^[18]
 - anti-psychotic medications may cause neuroleptic malignant syndrome, which can cause severe muscle